Faculty of Engineering and Technology
Datta Meghe Institute of Medical Sciences
(Deemed to be University)

NAAC Re-accredited Grade "A+"

Curriculum of General Aptitude
for AIPHDCET under DMIHER (DU)

Content:

Curriculum of **General Aptitude** for AIPHDCET, DMIHER (DU)

S. N.	Title
1	Verbal Aptitude**,** Quantitative Aptitude**,** Analytical Aptitude and Spatial Aptitude

Detailed Content

(Weightage = 15%)

Verbal Aptitude:

Basic English grammar: tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other parts of speech Basic vocabulary: words, idioms, and phrases in context reading and comprehension narrative sequencing.

Quantitative Aptitude:

Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data) and 3-dimensional plots, maps, and tables.

Numerical computation and estimation: ratios, percentages, powers, exponents and logarithms, permutations and combinations, and series Mensuration and geometry Elementary statistics and probability.

Analytical Aptitude:

Logic: deduction and induction, Analogy, Numerical relations and reasoning.

Spatial Aptitude:

Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping paper folding, cutting, and patterns in 2 and 3 dimensions.

References:

1. Dr. R.S. Aggarwal, *A modern Approach to Logical Reasoning* S. Chand Publisher, 2018
2. P.N. Arora and S. Arora, *Quantitative Aptitude Mathematics*, S. Chand India Publication.
3. Dr. R.S. Aggarwal, *A modern Approach to Verbal and Nonverbal Reasoning* S. Chand Publisher, 2018
4. Abhijit Guha, *Quantitative Aptitude for All Competitive Examinations*, McGraw Hill Publication.
5. Dr. R.S. Aggarwal, *Quantitative Aptitude* S. Chand, 2013

Faculty of Engineering and Technology
Datta Meghe Institute of Medical Sciences
(Deemed to be University)

NAAC Re-accredited Grade "A+"

Curriculum of Clinical Engineering
for
AIPHDCET under DMIHER (DU)
(Theme based)

Content:

Curriculum of **Clinical Engineering** for AIPHDCET, DMIHER (DU)

Theme	Title
1	Engineering Mathematics
2	Electrical Circuits, Signals and Systems
3	Analog and Digital Electronics, Measurements and Control Systems
4	Communications, Electromagnetic
5	Sensors and Bioinstrumentation, Medical Imaging System

Detailed Content

Theme1: Engineering Mathematics (Weightage = 13 %)

Linear Algebra: Matrix algebra, systems of linear equations, Eigenvalues and Eigenvectors.

Calculus: Mean value theorems, theorems of integral calculus, partial derivatives, maxima and

Minima, multiple integrals, Fourier series, vector identities, line, surface and volume integrals,

Stokes, Gauss and Green's theorems.

Differential equations: First order linear and nonlinear differential equations, higher order linear differential equations with constant coefficients, method of separation of variables, Cauchy's and Euler's equations, initial and boundary value problems, and solution of partial differential equations.

Analysis of complex variables: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, residue theorem.

Probability and Statistics: Sampling theorems, conditional probability, mean, median, mode and standard deviation, random variables, discrete and continuous distributions: normal, Poisson and binomial distributions, Tests of Significance, statistical power analysis, and sample size estimation, Linear Regression and correlation analysis.

Numerical Methods: Matrix inversion, numerical solutions of nonlinear algebraic equations, iterative methods for solving differential equations, numerical integration.

Theme 2: (Weightage = 18 %)

Electrical Circuits

Voltage and current sources - independent, dependent, ideal and practical, V-I relationships of

resistor, inductor and capacitor, transient analysis of RLC circuits with dc excitation, Kirchoff's laws, superposition, Thevenin, Norton, maximum power transfer and reciprocity theorems, Peak, average and RMS values of AC quantities; apparent, active and reactive powers, Phasor analysis, impedance and admittance, series and parallel resonance, realization of basic filters with R, L and C elements, Bode plot.

Signals and Systems

Continuous and Discrete Signal and Systems-Periodic, a periodic and impulse signals, Sampling theorem, Laplace and Fourier transforms, impulse response of systems, transfer function, frequency response of first and second order linear time invariant systems, convolution, correlation, Discrete time systems - impulse response, frequency response, DFT, Z - transform; basics of IIR and FIR filters.

Theme 3: (Weightage = 18%)

Analog and Digital Electronics

Basic characteristics and applications of diode,BJT and MOSFET, Characteristics and applications of operational amplifiers-difference amplifier, adder, subtractor, integrator, differentiator, instrumentation amplifier, buffer, filters and waveform generators. Number systems, Boolean algebra, combinational logic circuits-arithmetic circuits, comparators, Schmitt trigger, encoder/decoder, MUX/DEMUX, multi-vibrators, Sequential circuits-latches and flip flops, state diagrams, shift registers and counters, Principles of ADC and DAC, Microprocessor-architecture, interfacing memory and input- output devices.

Measurements and Control Systems

SI units, systematic and random errors in measurement, expression of uncertainty-accuracy and precision index, propagation of errors; PMMC, MI and dynamometer type instruments, dc Potentiometer, bridges for measurement of R, L and C, Q-meter.

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag lead compensation; State variable model and solution of state equation of LTI systems.

Theme 4: (Weightage = 18%)

Communication

Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems.

Analog communications: amplitude modulation and demodulation, angle modulation and Demodulation, spectra of AM and FM, super heterodyne receivers.

Information theory: entropy, mutual information and channel capacity theorem.

Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER. Fundamentals of error correction, Hamming codes, CRC.

Electromagnetic

Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector.

Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.

Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart. Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.

Theme 5: (Weightage = 18%)

Sensors and Bioinstrumentation

Sensors-resistive, capacitive, inductive, piezoelectric, Hall effect, electro chemical, optical, Sensor signal conditioning circuits, application of LASER in sensing and therapy, Origin of biopotentials and their measurement techniques-ECG, EEG, EMG, ERG, EOG, GSR, PCG, Principles of measuring blood pressure, body temperature, volume and flow in arteries, veins and tissues, respiratory measurements and cardiac output measurement. Operating principle of medical equipment-sphygmomanometer, ventilator, cardiac pacemaker, defibrillator, pulse oximeter, hemodialyzer Electrical Isolation (optical and electrical) and Safety of Biomedical Instruments.

Medical Imaging Systems

Basic physics, Instrumentation and image formation techniques in medical imaging modalities such as X-Ray, Computed Tomography, Single Photon Emission Computed Tomography, Positron Emission Tomography, Magnetic Resonance Imaging, Ultrasound.

References:

1. Kumar, A. Anand. *Fundamentals of digital circuits*. PHI Learning Pvt. Ltd., 2016.
2. Feucht, Dennis L. *Handbook of analog circuit design*. Academic Press, 2014.
3. Northrop, Robert B. *Signals and systems analysis in biomedical engineering*. CRC press, 2016.
4. Khandpur, Raghbir Singh. *Handbook of biomedical instrumentation*. McGraw-Hill Education, 1987.
5. Enderle, John. *Introduction to biomedical engineering*. Academic press, 2012.
6. Prince, Jerry L., and Jonathan M. Links. *Medical imaging signals and systems*. Upper Saddle River: Pearson Prentice Hall, 2006.
7. Northrop, Robert B. *Introduction to instrumentation and measurements*. CRC press, 2005.
8. Jain, Rajendra Prasad. *Modern digital electronics*. Tata McGraw-Hill Education, 2003.
9. Oppenheim, Alan V., Alan S. Willsky, Syed Hamid Nawab, and Gloria Mata Hernández. *Signals & systems*. Pearson Education, 1997.
10. Alexander, Charles K., Matthew NO Sadiku, and Matthew Sadiku. *Fundamentals of electric circuits*. Vol. 4. New York: McGraw-Hill, 2009.
11. Haykin, Simon, and Michael Moher. *Introduction to analog and digital communications*. Wiley, 2007.
12. Dass, H. K. *Higher Engineering Mathematics*. S. Chand Publishing, 2011.
13. Grewal, B. S., and J. S. Grewal. *Higher engineering mathematics*." Khanna Publishers, New Delhi, 2002.
14. Hayt Jr, William H., John A. Buck, and M. Jaleel Akhtar. *Engineering Electromagnetics| (SIE)*. McGraw-Hill Education, 2020.